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(54) Title of Utility Model: Honeycomb-Shaped Filter Element

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## Specification

### 1. Title of the Utility Model

Honeycomb-Shaped Filter Element

### 2. Claims

A honeycomb-shaped filter element, wherein a flat filter member and an undulating filter member are wound around a center pipe in scroll-like fashion, the obverse surface of both filter materials bonded together by the application of a sealing adhesive along the edges of the undulating filter member and the application of an adhesive at several places along the ridge lines of the various crest portions, and the reverse surface of both filter materials bonded together by the application of a sealing adhesive along the edges of the undulating filter member and the application of an adhesive at several places along the ridge lines of the various trough portions, and wherein the interval between the bonding positions along the ridge lines of the crest portions and trough portions of the obverse surface and reverse surface of the filter materials ranges between 20 mm and 30 mm.

### 3. Detailed Description of the Utility Model

(Industrial Field of Application)

The present utility model relates to a honeycomb-shaped filter element used primarily in air filters in which a flat filter member and an undulating filter member are wound around a center pipe in scroll-like fashion.

(Prior Art)

Honeycomb-shaped filter elements (e) usually consist of a flat filter member and an undulating filter member made out of filter paper. The construction method will now be summarized with reference to FIG 4 (a) and FIG 4 (b). First, as shown in FIG 4 (a), the flat filter member 1 and the undulating filter member 2 are arranged so that they face each other, and one edge of the surface of the undulating filter member 2 facing the other member (the obverse surface) is filled with a sealing adhesive 3 (such as a vinyl chloride-based adhesive) using an adhesive gun. At the same time, spots of a quickly drying adhesive 4 (such as a vinyl acetate-based adhesive) are applied along the ridge of the crest portions excluding the sealed portion as the members 1, 2 are rolled up. Next, as shown in FIG 4 (b), one edge of the bonded undulating filter member 2 on the surface opposite the one described above (the reverse surface) is filled with a sealing adhesive 3, and spots of a quickly drying adhesive 4 are applied along the ridge of the trough portions excluding the sealed portion. The integrated filter element is wound in scroll-like fashion around a center pipe 5 with one edge of the undulating filter member being sealed.

A filter element (e) is thus formed in which one edge is sealed with a sealing adhesive 3 leaving a plurality of channels open on the other side widthwise and in which both the obverse and reverse surfaces of the flat filter member 1 and the undulating filter member 2 are bonded to each other along the ridges of the crest portions.

In addition, a steel support ring 6 is placed on the top edge of the filter element (e) and another support ring 6 and elastic packing 7 are placed on the other

edge before being housed in a cup-shaped container (a) for use. A cover (b) is then attached, and the container (a) and the cover (b) are fastened by placing several clips (c) around the edge.

(Problem Solved by the Utility Model)

The obverse and reverse surfaces of the flat filter member 1 and undulating filter member 2 constituting the filter element are attached to each other by applying spots of adhesive at certain intervals along the ridge line of the crest and trough sections of the undulating filter member 2. Because the present interval in filter elements of the prior art is a relatively large 50 mm to 60 mm, the buckling strength of these filter elements is inadequate. When the element is placed inside the container (a), the cover (b) is attached, and the edges fastened using clips (c), the pressure applied to the periphery of the filter members causes the center to bulge laterally, the bonded portions to pull apart, and the filtering function to decrease.

However, when the bonded sections of the filter members 1, 2 are increased to strengthen the filter element, the effective filtering area of the filter members and the longevity of the filter are reduced.

The purpose of the present utility model is to provide a long-lasting filter element with high buckling strength by bonding both the obverse and reverse surfaces of the flat filter member and undulating filter member at the appropriate interval.

(Means of Solving the Problem)

The present utility model solves this problem by providing a honeycomb-shaped filter element, wherein a flat filter member and an undulating filter member are wound around a center pipe in scroll-like fashion, the obverse surface of both filter materials bonded together by the application of a sealing adhesive along

the edges of the undulating filter member and the application of an adhesive at several places along the ridge lines of the various crest portions, and the reverse surface of both filter materials bonded together by the application of a sealing adhesive along the edges of the undulating filter member and the application of an adhesive at several places along the ridge lines of the various trough portions, and wherein the interval between the bonding positions along the ridge lines of the crest portions and trough portions of the obverse surface and reverse surface of the filter materials ranges between 20 mm and 30 mm.

(Working Example)

FIG 1 and FIG 2 show a working example of the present utility model. A band-shaped flat filter member 11 and undulating filter member 12 are arranged so that they face each other, and edges of the obverse surface of the undulating filter member 12 (the surface facing the other member) are filled with a sealing adhesive 13 using an adhesive gun. At the same time, spots of a quickly drying adhesive 14 are applied at 20 mm to 30 mm intervals along the ridge of the crest portions excluding the sealed portion as the members are rolled up. The flat filter member 11 and the undulating filter member 12 are bonded to each other by the sealing adhesive 13 and the adhesive 14 applied along the ridge of the crest portions.

The edges of the reverse surface of the bonded undulating filter member 12 or the surface opposite the one shown in FIG 2 are then filled with a sealing adhesive 13, and spots of a quickly drying adhesive 14 are applied at 20 mm to 30 mm intervals along the ridge of the trough portions excluding the sealed portion. The integrated filter element is wound in scroll-like fashion around a center pipe 15 with one or both edges of the undulating filter member 12 sealed. The reverse surfaces of the flat filter member 11 and undulating filter member 12 are sealed by the sealing adhesive 13 and the adhesive 14 on the ridge line of the trough portion to form a rolled-up filter element (e) of a certain diameter.

A support ring is placed on one edge of the filter element (e) and either another support ring or elastic packing is placed on the other edge before being housed in a cup-shaped container.

FIG 3 is a graph showing the relationship of the interval between the bonding positions of the quick drying adhesive 14 on the obverse and reverse surfaces of the flat filter member 11 and the undulating filter 12 and the buckling strength and longevity of the element. Here, curve A denotes the buckling strength and curve B denotes longevity. As for the buckling strength of the element, the bonding position interval is inversely proportional to the strength. At intervals of 50 mm or less, there is a direct increase in strength. At 30 mm, the strength is 120 kg, while at 50 mm as in the prior art, the strength is 60 kg. In other words, the increase in strength is two fold. At 20 mm, the strength is 165 kg or 2.7 times the strength at 50 mm.

As for the longevity of the element, it sharply increases at intervals between 0 mm and 20 mm but rises only gradually between 20 mm and 50 mm. At intervals above 50 mm, the longevity of the element hardly changes at all.

The optimum value for the interval between bonding positions for the flat filter member 11 and the undulating filter member 12 was determined to range anywhere from 20 mm to 30 mm based on these consideration.

Therefore, in the present utility model, the interval between bonding positions for the flat filter member 11 and the undulating filter member 12 can be set anywhere between 20 mm and 30 mm.

(Effect of the Utility Model)

The present utility model provides a honeycomb-shaped filter element, wherein a flat filter member and an undulating filter member are wound around a center pipe in scroll-like fashion, the obverse surface of both filter materials bonded together by the application of a sealing adhesive along the edges of the undulating filter member and the application of an adhesive at several places along the ridge lines of the various crest portions, and the reverse surface of both filter materials bonded together by the application of a sealing adhesive along the edges of the undulating filter member and the application of an adhesive at several places along the ridge lines of the various trough portions, and wherein the interval between the bonding positions along the ridge lines of the crest portions and trough portions of the obverse surface and reverse surface of the filter materials ranges between 20 mm and 30 mm. As a result, the filter element has two to three times the buckling strength of filter elements of the prior art, and the element does not become warped in the middle, the bonded portions do not come apart, the filtering function does not decrease, and longevity is maintained even when placed inside a container, covered and fastened with clips. Therefore, the filter element is ideal for use in many different situations.

#### 4. Brief Explanation of the Drawings

FIG 1 is a perspective view of the bonding of the flat filter member and the undulating filter member in the filter element of the present utility model. FIG 2 is a perspective view of the rolled-up filter element. FIG 3 is a graph of test results. FIG 4 (a) is a perspective view of the bonding of the flat filter member and the undulating filter member in a filter element of the prior art. FIG 4 (b) is a perspective view of a rolled-up filter element of the prior art. FIG 5 is a cross-sectional view of the filter element housed in its container.

1, 11 ... flat filter member

2, 12 ... undulating filter member

3, 13 ... sealing adhesive

4, 14 ... adhesive

5, 15 ... center pipe

e ... filter element

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Agent: Shinichi SANADA, Patent Attorney

FIG 1

11 ... flat filter member

12 ... undulating filter member

13 ... sealing adhesive

14 ... adhesive

FIG 2

11 ... flat filter member

12 ... undulating filter member

13 ... sealing adhesive

14 ... adhesive

15 ... center pipe

e ... filter element

FIG 3



[horizontal axis] Bonding Position Interval  
[vertical axis] Buckling Strength

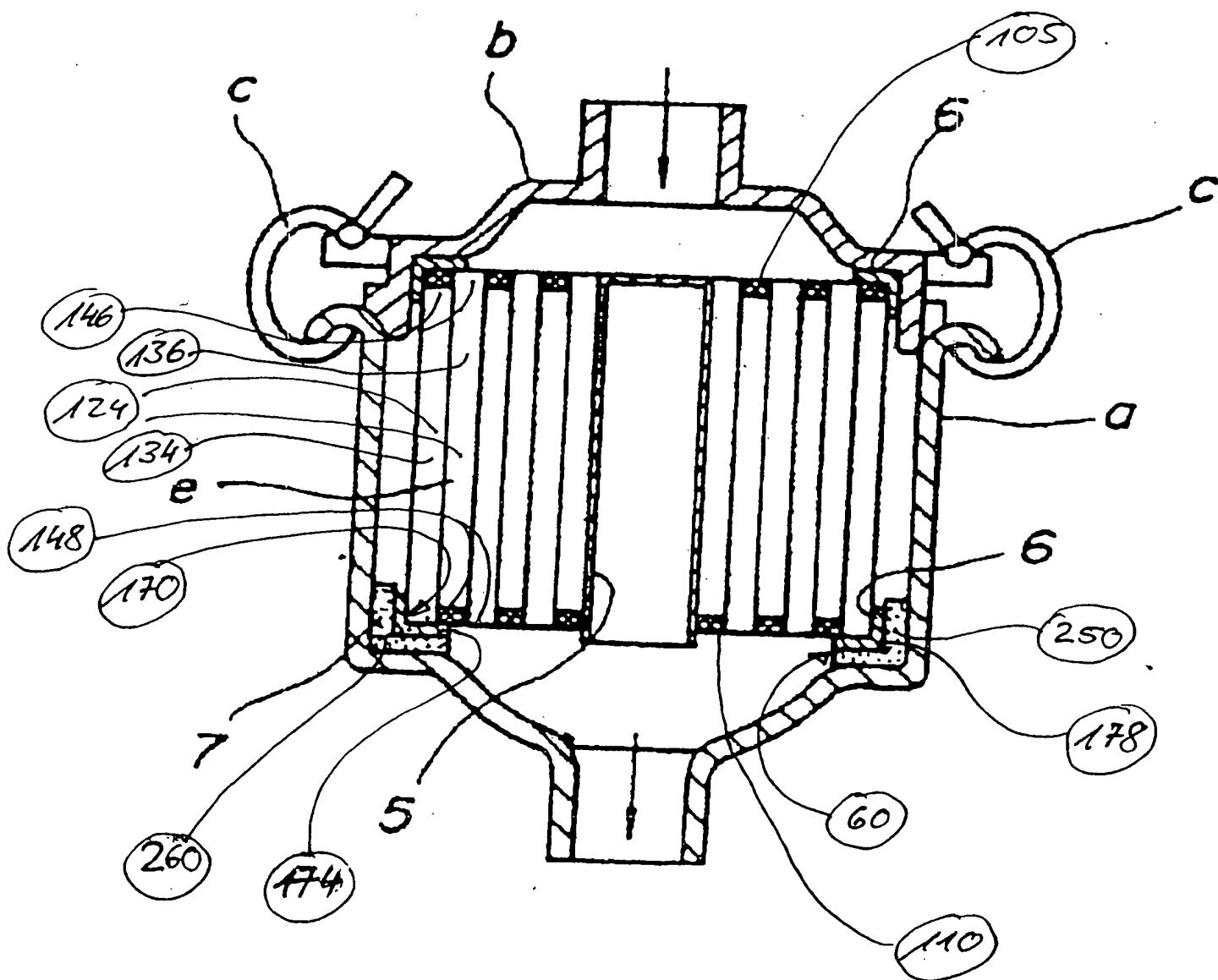
FIG 4

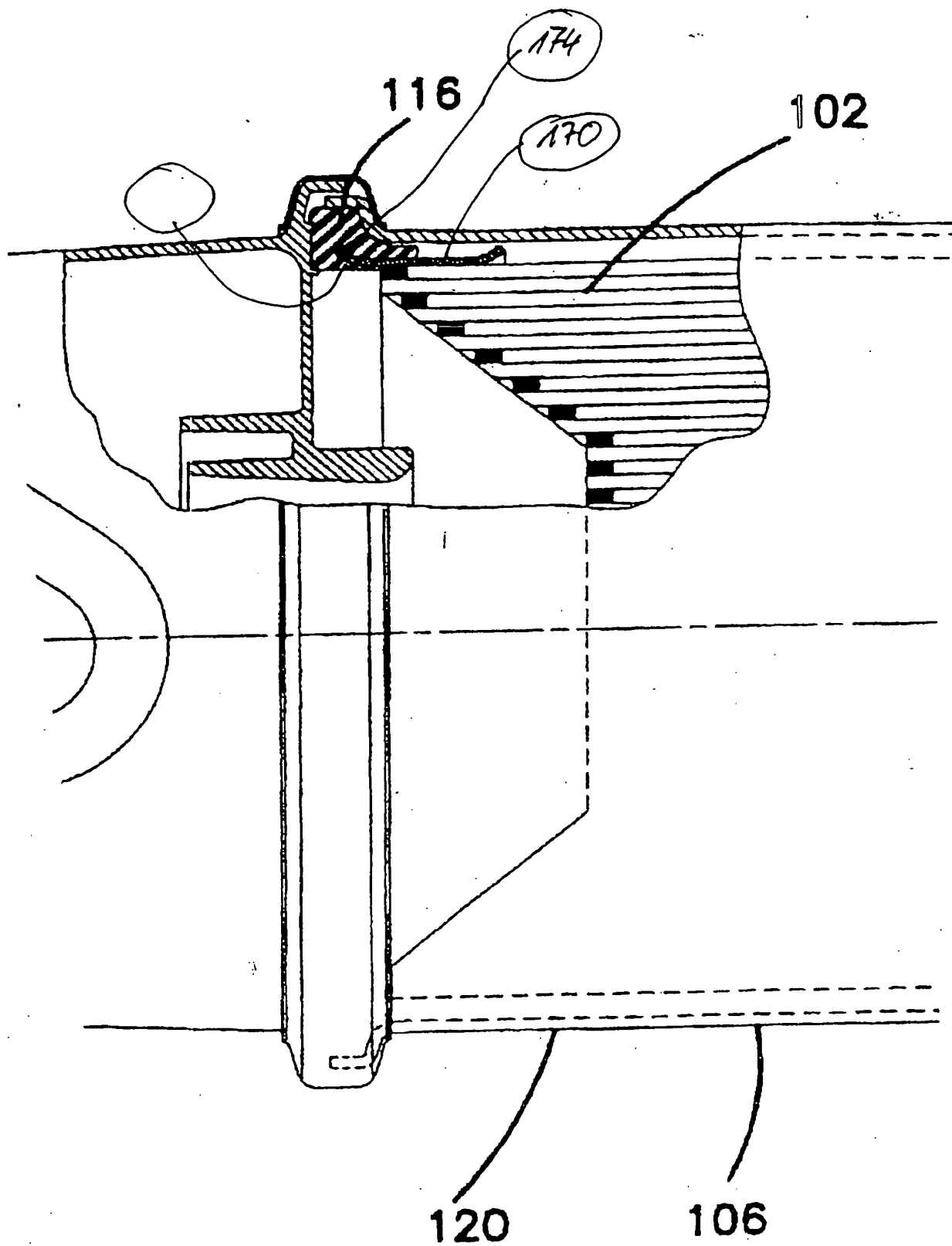
FIG 5

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# 第 5 図







JAPANESE PATENT OFFICE  
PATENT JOURNAL  
KOKAI UTILITY MODEL NO. SHO 59[1984]-170669 (U)

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AIR CLEANER

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[There are no amendments to this utility model.]

Claim

An air cleaner, characterized by the fact that a honeycomb body, having inlet parts and outlet parts of a number of mutually parallel through paths partitioned by a filter medium that are blocked in an alternate fashion, and having packings with projecting parts fixed to both ends of its outer peripheral wall, is arranged in a housing consisting of a casing constituted with one end open and the other end covered by a blocking plate with an outlet pipe, and of a cover being constituted with one end open and the other end covered by a blocking plate with an inlet pipe; and the open ends of the casing and the cover are coupled together in the vicinity of the center of the side wall of the honeycomb body.

### Detailed explanation of the invention

The present invention pertains to an air cleaner used in an internal combustion engine.

Recently, attempts have been made to make the parts constituting an internal combustion engine lighter in order to improve fuel consumption, and the lightness is also realized in air cleaners by removing constitutional parts or using plastic. Also, extending the service life of the elements of the air cleaner is important to make it more maintenance-free. In order to respond to these demands, an air cleaner in which an end plate is omitted by fixing an element to one of the two end lids of a cylindrical casing, and using the other end lid as an air flow inlet, is provided in Japanese Kokai Utility Model No. Sho 56[1981]-118951, while an air cleaner having an element wherein the filter is bag-shaped, with upper and lower end plates being omitted, is provided in Japanese Kokai Patent Application No. Sho 57[1982]-140554. However, in the former publication, due to the conventional chrysanthemum-shaped element, the service life cannot be prolonged without changing the filtration area. In the latter publication, since a vertical section of the element has a V shape, the number of folds that can be housed in the radial direction of one surface is limited, so that increase of the filtration area cannot be expected. The structure also requires a cap, and the number of constituent parts is not reduced, so that lightness cannot be realized.

The present invention provides an air cleaner in which these problems are solved. According to the constitution of this air cleaner, a honeycomb body, in which inlet parts and outlet parts of a number of mutually parallel through paths partitioned by a filter medium are blocked in an alternate fashion, is disposed in a housing consisting of a cylindrical casing and a cylindrical cover, and the above-mentioned casing and cover are coupled at the central part of the side wall of the honeycomb body. The number of constituent parts is reduced, so that lightness is achieved, and the service life is prolonged by increasing the filtration area. Furthermore, the honeycomb body can be easily replaced. The present invention will be explained in the following, using an application example.

An air cleaner 1 of Figure 1 is constituted by disposing a honeycomb body, such as spiral element 4, in a housing consisting of a tapered cylindrical casing 2 and a tapered cylindrical cover 3. The cylindrical casing 2 is open at one end, and a flange 21 is arranged at its outer periphery. The other end is blocked by a blocking plate 5 in which an outlet pipe 7 is arranged at the center and a step part 6 is arranged at the outer peripheral edge. Also, a so-called tapered shape is formed from the opening at one end toward the blocking plate 5 at the other end. The distance between the flange 21 and the blocking plate 5 is half the length of the element 4. The cylindrical cover 3 is open at one end, and a flange 31 with the same diameter as that of the above-mentioned casing flange 21 is arranged at its outer periphery. A step part 9 is arranged at the outer peripheral edge of the other end, and the other end is blocked by a blocking plate 8 in

which an inlet pipe 10 is installed. Then, similarly to casing 2, a tapered shape is formed toward the blocking plate 8. The casing flange 21 and the cover flange 31 are secured by an attachment means such as clip 11 and a bolt, so that a housing is formed. The spiral element 4 is arranged in said housing. Also, the housing 2 and the cover 3 can be straight without being limited to the tapered shape, and a wire mesh or a drilled steel plate can also be arranged in the inlet pipe 10 of the cover 3.

In the spiral element 4, as shown in Figure 2, a flat filter medium 41 and a corrugated filter medium 42 having ridges 43 and valleys 44 are superposed, with the ridges 43 at one end and the valleys 44 of the other end being blocked, and this is spirally wound on a core cylinder 45. Also, in the spiral element 4, the flat filter medium can have a U shape and be spirally wound on the core cylinder and blocked in an alternate fashion. Also, at the upper and lower ends of the outer peripheral wall of the element 4, as shown in Figure 3, are urethane packings 12 and 13 with an outer diameter slightly smaller than the inner diameter of the casing 2 and with projecting parts 14 and 15 projecting past the end surface of the element 4 and fastened on the end edge surface, and these projecting parts 14 and 15 slope gradually to the outer peripheral peak A.

In the air cleaner 1 with such a constitution, air containing dust is introduced via an opening 33 in the cover 3 when an internal combustion engine is started; it passes through the filter medium of the element 4, is purified, and is sent to the internal combustion engine, not shown in the figure, via the outlet pipe 6. At that time, the projecting parts 14 and 15 of the urethane packings 12 and 13 arranged at the upper and lower ends of the element 4 are pressed by the ends 14 and 15 [sic] of the outer peripheral edges of the casing 2 and the cover 3, so that they are not moved by forces in the vertical direction due to vibrations of the internal combustion engine, and are buffered by the outer peripheral parts of the packings 12 and 13 that are in contact with the casing 2 and the cover 3. Thereby, no stress is exerted on the inner peripheral parts of the packings 12 and 13 secured with the element 4, and separation from the element 4 is prevented. As a result, sealing is assured. Also, the packings 12 and 13 in contact with the step parts 6 and 9 of the casing 2 and the cover 3 always secure the element 4 against forces in the horizontal direction due to the vibrations of the internal combustion engine, and no gap allowing a sealing leak is created. Then, in case the element 4 becomes clogged and is replaced, if the clip 11 installed in the flange 21 is released and the casing 2 or cover 3 is removed, the side wall of the element 4 appears, and the element can be easily replaced by gripping the side wall.

As mentioned above, according to the air cleaner of the present invention, since a simple cover for securing the element arranged in the casing is used without using an end plate of the element, the number of parts constituting the air cleaner is reduced, so that lightness can be achieved. Then, during replacement of a clogged element, because the side wall part of the element can be gripped, the element can also be easily replaced. Also, in the honeycomb body,

since the inlet parts and the outlet parts of a number of mutually parallel through paths partitioned by the filter medium are blocked in an alternate fashion, the filtration area is increased, so that the service life can be prolonged.

Brief description of the figures

Figure 1 is a cross section showing the air cleaner of the present invention. Figure 2 is a spiral element shown as an application example. Figure 3 is a detail diagram showing a step part and a urethane packing.

- 1 Air cleaner
- 2 Casing
- 3 Cover
- 4 Honeycomb body
- 6, 9 Step parts
- 12, 13 Packings

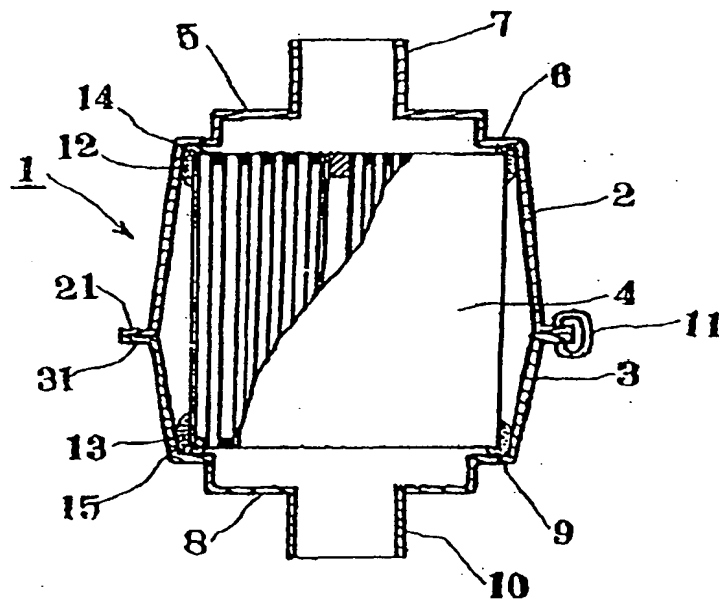


Figure 1

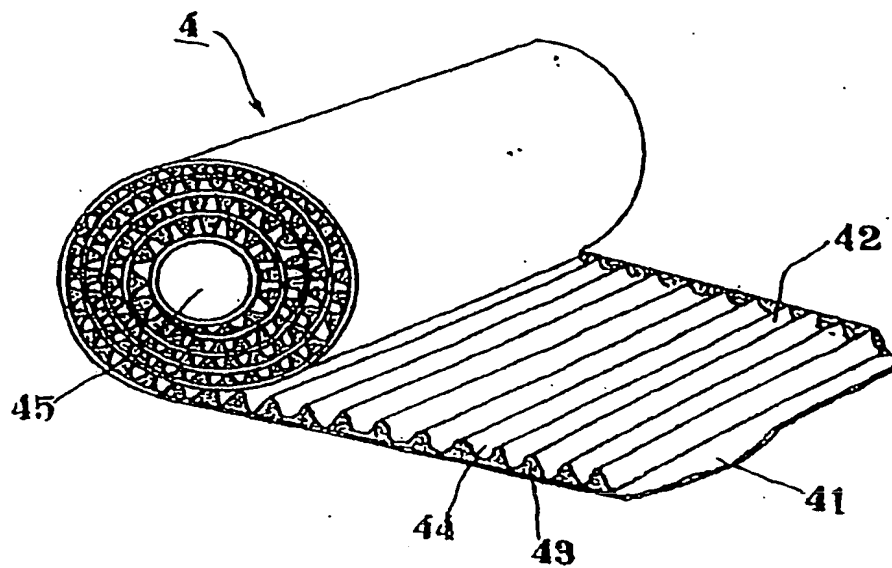


Figure 2

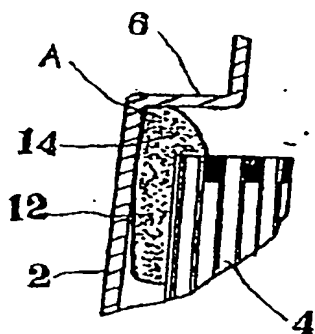


Figure 3



# 公開実用 昭和63- 122617

⑨ 日本国特許庁(JP)

⑩ 実用新案出願公開

⑪ 公開実用新案公報(U) 昭63-122617

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⑬ 公開 昭和63年(1988)8月9日

審査請求 未請求 (全 頁)

⑭ 考案の名称 ハニカム形の戸過エレメント

⑮ 実 願 昭62-11413

⑯ 出 願 昭62(1987)1月30日

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## 明 細 書

## 1. 考案の名称

ハニカム形の戸過エレメント

## 2. 実用新案登録請求の範囲

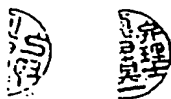
平板戸材と波付け戸材からなつてセンターパイプ上にうず巻き状に巻回され、両戸材の表面同志は波付け戸材の一侧側縁に施されたシール用の接着剤と波の各山部の稜線上の複数箇所に塗布された接着剤によつて接着され、また、裏面同志は波付け戸材の他側側縁に施されたシール用の接着剤と波の各谷部の稜線上の複数箇所に塗布された接着剤によつて一体に接合されるハニカム形の戸過エレメントにおいて、上記両戸材の表面および裏面における波の山部または谷部の稜線上の接着位置の間隔を20mmないし30mmにしたことを特徴とするハニカム形の戸過エレメント。

## 3. 考案の詳細な説明

(産業上の利用分野)

この考案は平板戸材と波付け戸材とを重ね合

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せてセンターパイプの回りにうず巻き状に巻き付けるいわゆるハニカム形の戸過エレメントに関し、主としてエアーフィルター用の戸過エレメントに関する。

(従来 of 技術)

一般にハニカム形の戸過エレメント  $e$  は戸紙などの平板戸材と波付け戸材からなるが、その作り方の概略を示せば第4図イ、ロのとおりであり、先ずイ図のように平板戸材1と波付け戸材2とを向き合せ、波付け戸材1の向き合う面(両戸材とも表面という)の片側側縁にシール用の接着剤(塩化ビニル系のものなど)3を塗布ガンにより充填的に施すと共に波の山部稜線上に一定の間隔で速乾性の接着剤(醋酸ビニル系のものなど)4をのり付けロールでスポット的に塗布しつつ両戸材1、2を一体的に接着する。次いで、このものをロ図のように波付け戸材2を内側にし(その裏面が上になつて表われる)、上記側縁とは反対側の側縁にシール用の接着剤3を塗布ガンにより充填的に施す一方、



波の谷部の稜線上には山部と同じ間隔で速乾性の接着剤4をのり付けロールでスポット的に塗布しながら、一端の閉じたセンターパイプ5の周りにうず巻き状に巻き付ける。

このようにして、一端縁がシール用接着剤3で閉じられ他端縁が開放された幅方向の多数の通路が形成され、かつ平板材1と波付け戸材2の表面同志または裏面同志が波の稜線のところで接着された戸過エレメントeが作られる。

しかして、この戸過エレメントeは使用時に上部になる一端縁に鉄板製の補強リング6が施されると共に下部になる他端縁には補強リング6と弾性パッキング7が施されて、コップ状の容器aに収容され、その上にカバーbが被嵌され、容器aとカバーbとの周縁を複数のクリップ部材cで緊締して用いられる。

(考案の解決しようとする問題点)

上記のように戸過エレメントの要素をなす平板戸材1と波付け戸材2は、製作上その表面同

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志および裏面同志が波付け戸材2の波の山部または谷部の稜線に沿って一定間隔にスポット接着されるが、従来の戸過エレメントではその接着間隔が50mm～60mmと比較的に大きいために、戸過エレメントとしての坐屈強度が充分でなく、エレメントを容器a内に収容しカバーbを施して両者の周縁部をクリップcで緊締すると、周囲部の戸材が圧迫によつて中央が側方にふくらむように変形し、接着部が剥がれて戸過機能を低下させてしまう。

一方、戸過エレメントの強度を増すために両戸材1、2の接着部分をやたらに多くすると、戸材の有効戸過面積が減少してエレメントの寿命が短くなってしまう。

そこで、この考案は平板戸材と波付け戸材との表裏両面を適切な位置間隔で接着し、高い坐屈強度を備えかつ寿命の永い戸過エレメントを提供するものである。

(問題点を解決するための手段)

上記目的のもとにこの考案は、平板戸材と波

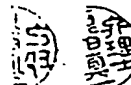


付け戸材からなつてセンターパイプ上にうず巻き状に巻回され、両戸材の表面同志は波付け戸材の一侧側縁に施されたシール用の接着剤と波の各山部の稜線上の複数箇所に塗布された接着剤によつて接着され、また、裏面同志は波付け戸材の他側側縁に施されたシール用の接着剤と波の各谷部の稜線上の複数箇所に塗布された接着剤によつて一体に接合されるハニカム形の戸過エレメントとして、上記両戸材の表面および裏面における波の山部または谷部の稜線上の接着位置の間隔を20mmないし30mmにしたことを特徴とするものである。

(実施例)

第1図、第2図はこの考案の実施例を示すものであり、帯状の平板戸材11と波付け戸材12が向き合され、波付け戸材12の表面(向き合う面)の片側側縁にシール用の接着剤13が塗布ガンにより充填的に施され、それと同時に波の各山部の稜線上でシール部を除く部分に20mm ~ 30mmの間隔で速乾性の接着剤14がの

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り付けロールによつてスポット的に塗布され、平面戸材11と波付けロール12はシール用の接着剤13と波山稜線上の接着剤14によつて一体的に接着されている。

そして、この一体化されたものの波付け戸材12の裏面には、第2図のように表面接着側縁と反対側の側縁にシール用の接着剤13が充填的に施されかつ波の各谷部の稜線上でシール部を除く部分に20mm～30mmの間隔で速乾性の接着剤14がスポット的に塗布され、その一体化戸材は波付け戸材12を内側にして両端または一端が閉じられたセンターパイプ15の周りにうず巻き状に巻き付けられ、平板戸材11と波付け戸材12の裏面同志もシール用接着剤13と谷部稜線上の接着剤14によつて一体に接着された所要直径のロール状の戸過エレメントeに形成されている。

そして、この戸過エレメントeは前記のように一端縁に補強リングが取付けられ、他端縁には補強リングと弾性バッキングが施されてコッ

ブ状の容器に収容されて使用される。

第3図は平板戸材11と波付け戸材12の表面および裏面における速乾性接着剤14による接着位置の間隔と、エレメントとしての坐屈強度および寿命との関係をぐらふにしたもので、A曲線は坐屈強度を、B曲線は寿命を表わすが、先ず、エレメントの坐屈強度についてみれば、接着位置の間隔と強度は逆比例しており、50mm以下の間隔になると直線的に強度が増し、30mmでは120Kgで従来の50mm間隔の60Kgに比べ2倍の強度となり、また、20mm間隔では165Kgで50mm間隔の強度に対し2.7倍の強度を保有する。

一方、エレメントの寿命についてみれば、間隔0から20mmの間では間隔の増加につれて急激に増加し、20mmから50mmの間ではゆるやかなカーブを描いて上昇し、間隔50mm以上ではエレメントの寿命は殆んど変らないことを示している。

これらの事実からして、平板戸材11と波付



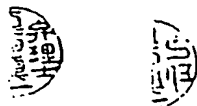
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け戸材12との接着間隔の最適値は20mm～30mmといふことができる。

したがつて、本考案では平板戸材11と波付け戸材12の表裏両面における接着位置の間隔を20mm～30mmに選択するものである。

(考案の効果)

上述のようにこの考案では、平板戸材と波付け戸材からなつてセンターパイプ上にうず巻き状に巻回され、両戸材の表面同志は波付け戸材の一侧側縁に施されたシール用の接着剤と波の各山部の稜線上の複数箇所に塗布された接着剤によつて接着され、また、裏面同志は波付け戸材の他側側縁に施されたシール用接着剤と波の各谷部の稜線上の複数箇所に塗布された接着剤によつて一体に接合されるハニカム形の戸過エレメントとして、両戸材の表面および裏面における波の山部または谷部の稜線上の接着位置の間隔を20mmないし30mmにしたので、戸過エレメントは従来のものに比べて2倍ないし3倍程度の大きな坐屈強度を持ち、エレメントを容



器に収納しカバーを施してクリップ部材で緊締にしたにしても、エレメントは中太りに変形せず、接着部が剥離することなく、戸過機能を低下させずに永い寿命を維持することができ、この種の戸過エレメントとして最適なものである。

#### 4. 図面の簡単な説明

第1図はこの考案に係るエレメントの平板戸材と波付け戸材の接着状態を示す斜視図。

第2図は戸材をロール状に巻く状態の斜視図。

第3図は試験の結果のぐらふ。

第4図イは従来品の平板戸材と波付け戸材の接着状態を示す斜視図。

同 図ロは従来品の戸材を巻く状態の斜視図。

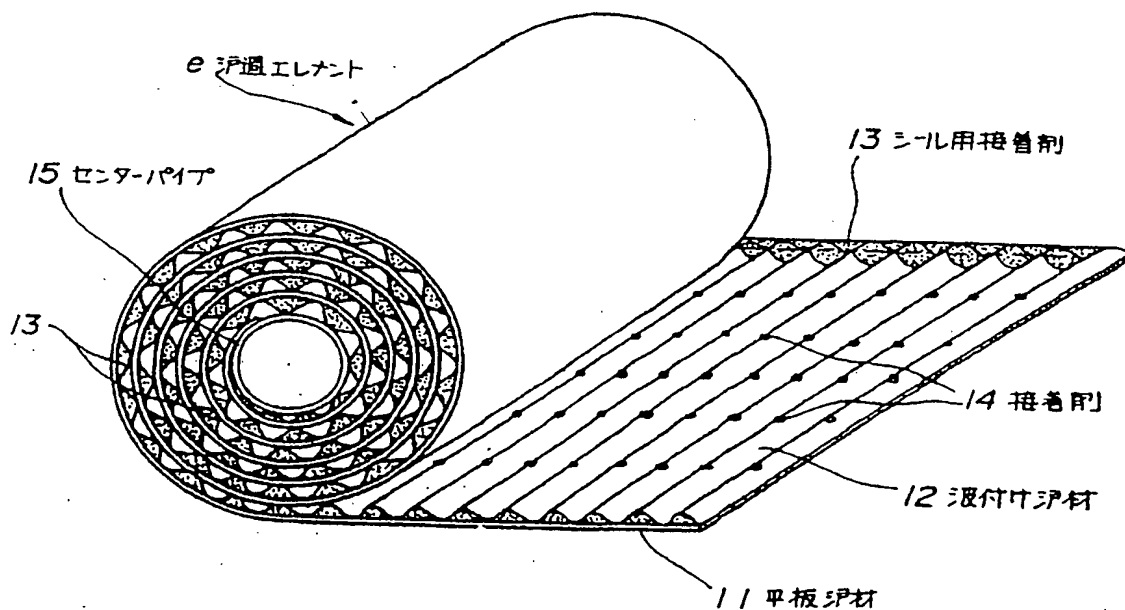
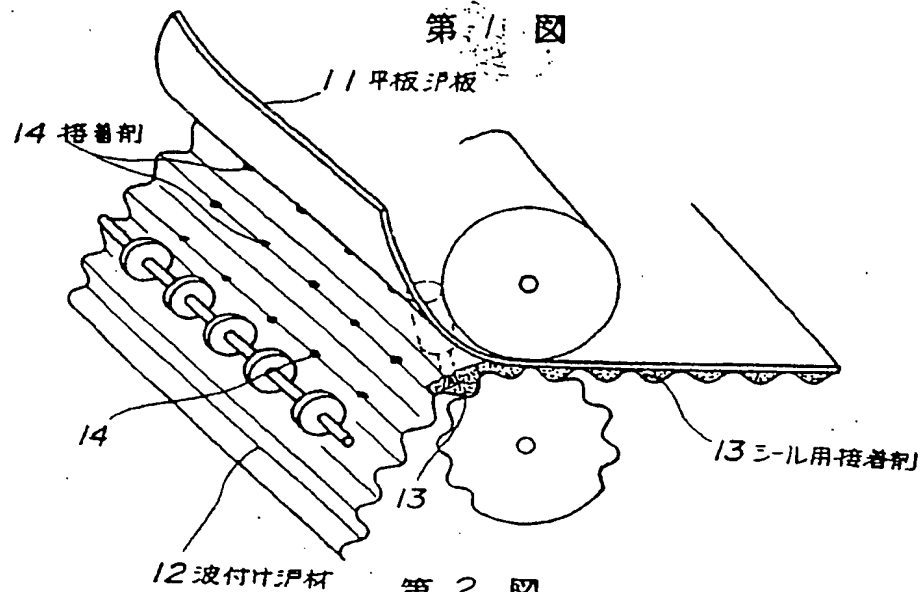
第5図はエレメントを容器に収納した状態の断面図。

図中、

- |               |                 |
|---------------|-----------------|
| 1、11……平 板 戸 材 | 2、12……波 付 け 戸 材 |
| 3、13……シール用接着剤 | 4、14……接 着 剤     |
| 5、15……センターパイプ | e ……戸過エレメント     |

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第 15 圖



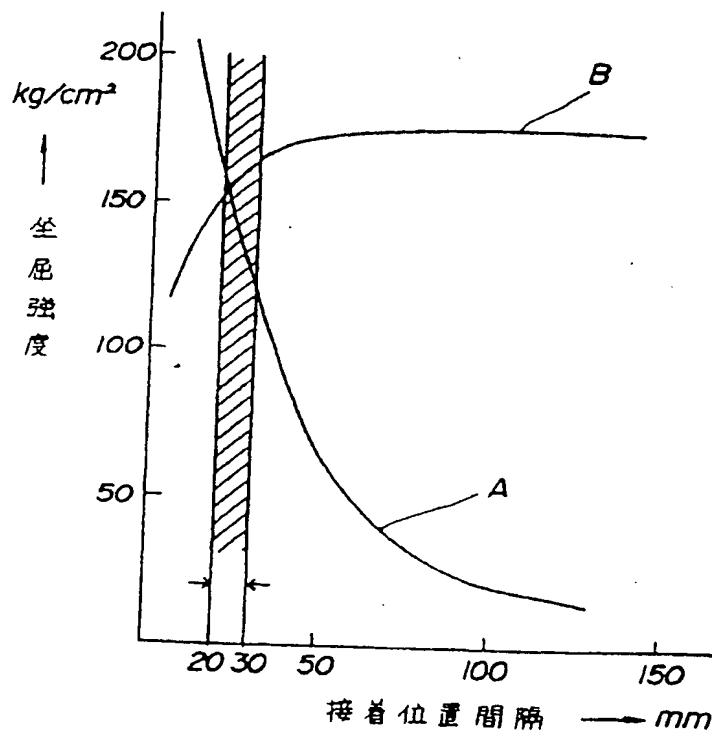
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第 3 図



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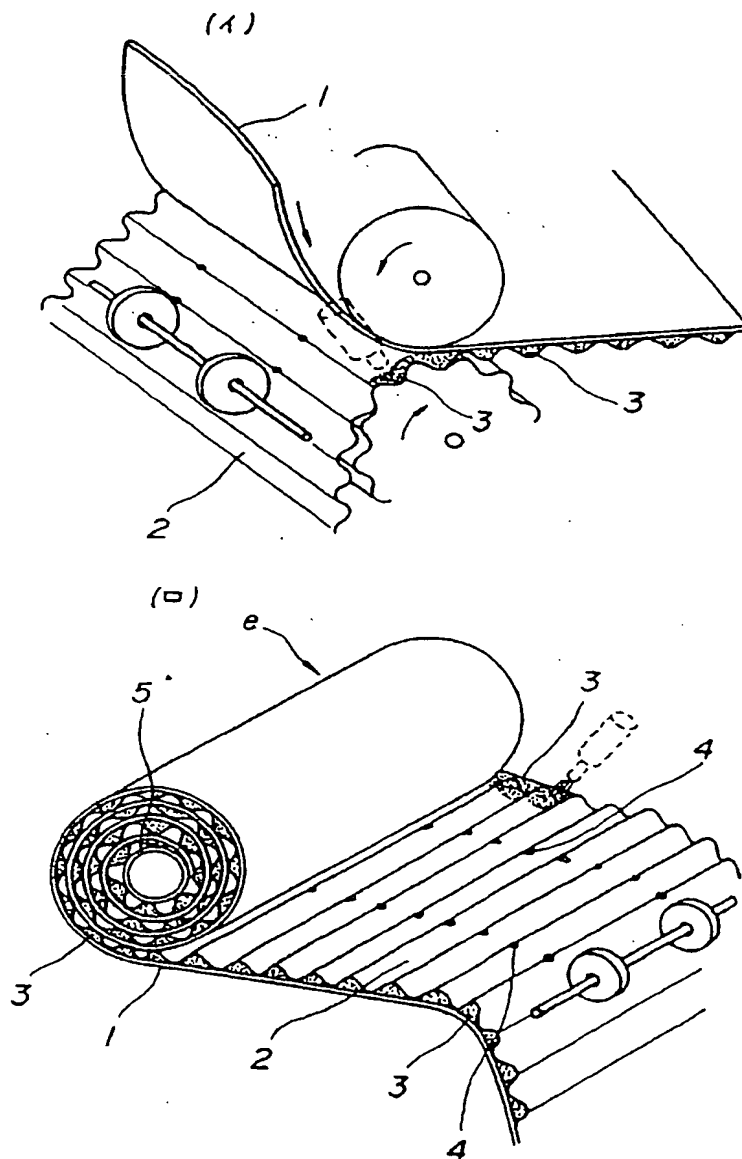
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第4図



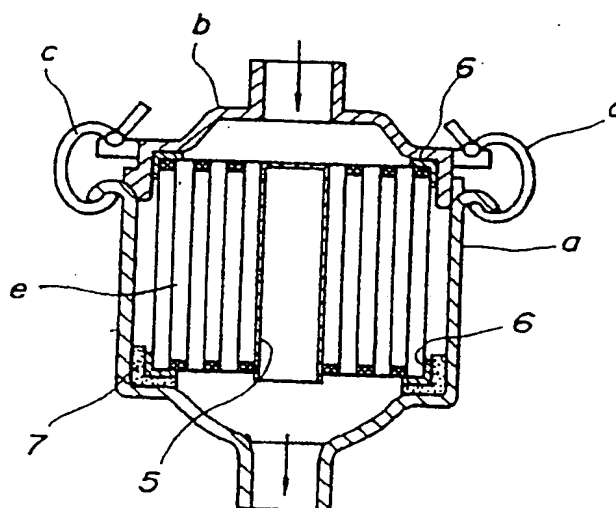
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第 5 図



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